CLAIMS

What is claimed is:

1. A method for oxidative dehydrogenation comprising

a) providing a reactant mixture comprising one or more hydrocarbons and an oxidant;

b) providing an ODH catalyst comprising a base metal selected from the group consisting of lanthanide metals, their oxides and combinations thereof;

c) exposing the reactant mixture to the ODH catalyst in a reactor under reaction promoting conditions; and

d) oxidatively dehydrogenating at least a fraction of the one or more hydrocarbons in the reactant mixture.

2. The method of claim 1 wherein the reactor is a short contact time reactor operated at a GHSV between about 20,000 hr^{-1} and about 200,000,000 hr^{-1}.

3. The method of claim 1 wherein the reactor is a short contact time reactor operated at a GHSV between about 50,000 hr^{-1} and about 50,000,000 hr^{-1}.

4. The method of claim 1 wherein the oxidant comprises a molecular oxygen-containing gas and the one or more hydrocarbons comprise one or more alkanes.

5. The method of claim 4 wherein the one or more alkanes comprise one or more paraffins with between 2 and 10 carbon atoms.

6. The method of claim 4 wherein the one or more alkanes comprise one or more paraffins with between 2 and 5 carbon atoms.

7. The method of claim 4 further comprising the step of pre-heating the reactant mixture to about 600°C or less.

8. The method of claim 4 further comprising the step of preheating the reactant mixture to about 300°C or less.

9. The method of claim 4 wherein the atomic oxygen-to-carbon ratio is between about 0.05:1 and about 5:1.

10. The method of claim 4 wherein the alkane conversion is at least about 40 percent and the alkene selectivity is at least about 35 percent.

11. The method of claim 4 wherein the alkane conversion is at least about 85 percent and the alkene selectivity is at least about 60 percent.

12. The method of claim 1 wherein the base metal is present at a base metal loading between about 0.5 and about 20 weight percent.

13. The method of claim 1 wherein the base metal is present at a base metal loading between about 2 and about 10 weight percent.

14. The method of claim 1 wherein the base metal is selected from the group consisting of samarium, cerium, praseodymium, terbium, their corresponding oxides and combinations thereof.

15. The method of claim 1 wherein the ODH catalyst further comprises a promoter metal selected from the group consisting of Group VIII metals, their oxides and combinations thereof and present at a promoter metal loading between about 0.005 and 0.10 weight percent.

16. The method of claim 1 wherein the ODH catalyst further comprises a promoter metal selected from the group consisting of rhodium, platinum, palladium, ruthenium or iridium and combinations thereof.

17. The method of claim 15 wherein the ODH catalyst has a molar ratio of base metal to promoter metal of about 10 or more.

18. The method of claim 15 wherein the ODH catalyst has a molar ratio of base metal to promoter metal of about 25 or more.

19. The method of claim 1 wherein the ODH catalyst further comprises a refractory support.

20. The method of claim 19 wherein the refractory support is comprised of a material selected from group consisting of zirconia, stabilized zirconias, alumina, stabilized aluminas, and combinations thereof.

21. The method of claim 19 wherein the ODH catalyst further comprises a promoter metal selected from the group consisting of Group VIII metals, their oxides and combinations thereof and present at a promoter metal loading between about 0.005 and 0.10 weight percent.

22. The method of claim 19 wherein the ODH catalyst further comprises a promoter metal selected from the group consisting of rhodium, platinum, palladium, ruthenium or iridium and combinations thereof.

23. The method of claim 21 wherein the ODH catalyst has a molar ratio of base metal to promoter metal of about 10 or more.

24. The method of claim 21 wherein the ODH catalyst has a molar ratio of base metal to promoter metal of about 25 or more.